AgriSustainability Matters

Issue 2 - August 2020 - Embassy of Brazil in London

Ambassador's word

Dear friends,

As discussions for a green recovery continue to gain pace worldwide, we dedicate the second issue of our bulletin to biofuels, a cornerstone of the sustainability agenda.

Holding a PhD in Agricultural Economics and with an extensive involvement in policymaking, Dr Plinio Nastari writes an enlightening piece about Brazil's innovative regulation for sustainable mobility and biofuels: RenovaBio.

Sound agricultural production has the potential not only to ensure our food security, but also to power our economies in a sustainable way. Brazil's experience shows that the benefits of biofuels are manifold, ranging from environmental compliance to air quality enhancement and job creation. In fact, a recent study by the International Energy Agency (IEA) is placing biofuels as one of the most job-intensive sectors for a green recovery worldwide.

Now as ever, AgriSustainability Matters. Enjoy the reading.

Fred Arruda
Ambassador of Brazil to the UK

Plinio Nastari

Brazil's modern & innovative regulatory framework for sustainable mobility using biofuels

Sugarcane, the first and oldest crop in Brazil, is the second most important source of energy in the country, making up 18% of the total primary energy supply, second only to petroleum products (34.4%), and ahead of hydraulic energy (12.4%)[1]. Sugarcane for ethanol, which occupies only 0.7% of Brazil's territory, produces enough ethanol to substitute 46% of all gasoline sold in the country (2019). This is possible through the blending of anhydrous ethanol in gasoline in the proportion of 27% of its volume, and through its use as a sole fuel, as hydrous ethanol, in flex-fuel vehicles which account for over 80% of the light vehicle fleet. Gasohol and pure hydrous ethanol are sold in over 41,700 fuel stations where consumers select the fuel based on freely determined market prices. The achievement of higher ethanol blends in gasoline, an objective currently pursued by many countries, has been a reality in Brazil since the late 1970s. Biodiesel is blended in diesel fuel at the rate of 12%, and is projected to rise to 15% by 2023.

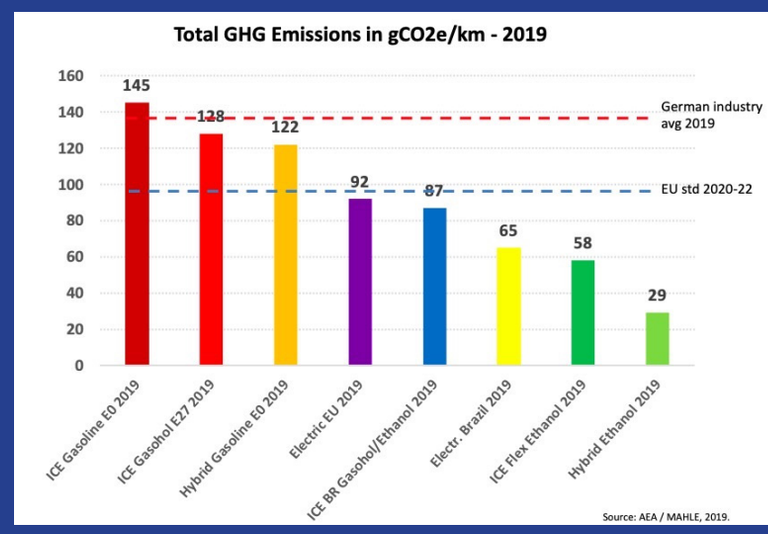
The social, economic and environmental benefits of Brazil's renewable fuels matrix through biofuels are far reaching. Sugarcane has intensified and capitalised agriculture for the production of other crops in rotation and in parallel to cane. It engages 870,000 direct and 2.5 million indirect jobs, and since 1975 it has accumulated savings of 3.15 billion barrels in gasoline imports, with an estimated value of 540 billion US dollars, including interest on foregone debt. This is a significant achievement considering that Brazil's crude oil and gas proven reserves total 15.2 billion barrels including pre-salt. The human development index in cities where sugarcane is grown is consistently higher, due to the creation of decentralised jobs and the circular economy it generates. Studies indicate that per-capita income in cities where sugarcane mills are located rises by 1,100 US dollars, and in nearby cities by 400 US dollars.

Air pollution has improved significantly as ethanol substitutes tetra-ethyl lead and carcinogenic aromatics in gasoline. Instead of formaldehydes formed in gasoline combustion, ethanol generates acetaldehydes, which are far less toxic. Volatile organic compounds from ethanol combustion are less reactive than those caused by gasoline, thus reducing formation of secondary pollutants. Also, ethanol and biodiesel do not generate particulate matter, in particular fine $PM^{2.5}$, which is directly linked to respiratory diseases of specific importance in the current pandemic times. A recent study conducted by the Harvard T.H. Chan School of Public Health has found significant correlation between air pollution, measured as particulate matter, and health implications related to Covid contamination.

"Ethanol is 'hydrogen-on-the-bucket' accessible, economical and environmentally-wise to produce, store and distribute"

Biofuels are at the centre of Brazil's strategy for renewable energy in transportation and sustainable mobility, integrating a low-carbon source of energy which promotes jobs and income using existing expertise and potential, with the most advanced automotive technology. Considering the complete carbon life cycle assessment under the "well-to-wheel" concept, internal combustion engine vehicles using ethanol emit only 58 grams of CO_2 equivalent per km (g CO_2e/km). Electric vehicles using ethanol, through hybrids launched in the market in September 2019, are emitting 29 g CO_2Eq/km, much less than the battery electric vehicles sold in the EU and operating with the EU's largely fossil-based power mix (92 g CO_2Eq/km), or the hybrids using gasoline with zero ethanol (122 g CO_2Eq/km). The mix of ethanol and gasoline in use in Brazil produces average emissions of 87 g CO_2Eq/km, indicating that ethanol provides sustainability and longevity for the use of traditional fuels, using the existing fuel distribution system. This is relevant since the Energy Planning Enterprise (EPE), the planning body of Brazil's Ministry of Mines and Energy, concluded that investments of 210 to 330 billion US dollars are required to install a smart grid for recharging batteries, not to mention the economic and environmental costs associated with the production and discharge of batteries.

The use of batteries should not be mistaken with electrification. Battery technology is just one option for energy storage. The source of energy and the environmental and economic implications of its generation, storage and distribution are the relevant matters. But the fact is that batteries do have a relatively low energy density, in the range of 150 to 200 Wh/kg, whereas the industry target is to achieve 330 Wh/kg, and emerging technologies and materials may one day enable them to reach 700 to 900 Wh/kg. In comparison, the energy density of ethanol is already a degree of magnitude larger, at 6,200 Wh/kg. The low energy density of batteries determines the limited range and the high cost of battery electric vehicles.



Instead of batteries, Brazil's vision for sustainable mobility is based on the use of high-energy density low-carbon fuels, such as ethanol, biodiesel and biomethane, used alone or in association with traditional fuels. The high hydrogen content of ethanol means that the current fuel distribution system is actually a hydrogen distribution system. Ethanol is "hydrogen on-the-bucket", accessible, economical and environmentally-wise to produce, store and distribute.

Building on this experience, Brazil has developed a new regulatory framework - the New National Biofuels Plan, or RenovaBio. This new regulation takes advantage of the high-energy density of ethanol; avoids the trap of fossil-derived electricity; considers electrification with ethanol as the option with the lowest GHG emission; uses existing liquid fuel distribution infrastructure; avoids concerns over the availability and sourcing of lithium and cobalt, the limited life-span and discarding of batteries and the pollution it generates; and is the option that promotes development (jobs and income) while simultaneously integrating energy, agricultural, industrial and environmental public policy objectives. Designed at Brazil's National Council for Energy Policy, and enacted into law in December 2017, RenovaBio is coming into full implementation in 2020 and represents a relevant strategy to reinforce policy towards biofuels and the achievement of Brazil's commitments to the Paris Agreement on Climate Change.

With RenovaBio, innovation and efficiency in biofuel production and use are placed at the centre of Brazil´s strategy for the use of low carbon sources of energy, without creating a subsidy or a carbon tax. It is a regulation based on the induction of energy efficiency in the production and use of biofuels, recognising the capacity of each biofuel to promote carbon emissions reductions. The objective is to create a market-driven mechanism to promote the expansion of biofuel/bioenergy in the final energy demand, including land, sea and air transport, based on sustainable practices, and increased energy-environmental efficiency. This mechanism relies on a system of voluntary certification of biofuel producers for their energy-environmental efficiency, based on life-cycle assessment (LCA), which determines the ability to request issuance of Decarbonization Credits (CBios). Financial institutions issue CBios which are freely negotiated at the stock exchange, and public policy will only be in charge of defining the long-term carbon reduction target for the fuels sector. This will lead to individual fuel distributor carbon reduction targets to be met by the acquisition of CBios. Carbon reduction targets provide predictability for the expansion of biofuels' share in the transport sector. Current decarbonisation targets approved under RenovaBio will avoid the emission of 700 million tons of carbon in the transport sector by 2029, making it by far the largest effective decarbonisation programme in the world.

"RenovaBio incorporates zero deforestation as one of the eligibility criteria for certification of biofuel producers"

Such carbon-pricing mechanism responds to endogenous, not exogenous, price determination. It unleashes market forces to implement and drive innovation for increased sustainability in biofuel and bioenergy production. It stimulates continued demand growth, independent of government mandates, and does not elect or predefine champions.

RenovaBio incorporates zero deforestation as one of the eligibility criteria for certification of biofuel producers. This means that biofuel production cannot be based on feedstocks coming from deforested areas, and all areas under cultivation must be registered under Brazil's strict Forestry Code's CAR (Rural Environmental Registry) requirements. More than a model of sustainable energy production, RenovaBio has consolidated a project of integrated economic development, using the potential for expansion of bioenergy production.

Brazil's initiative is in accordance with the Biofuture Platform's Vision Declaration (http://www.biofutureplatform.org/declarations) issued at COP-23 in Bonn, on November 17, 2017, by 19 nations representing over half the world's population, and endorsed by the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA). This declaration recognised that, in order to achieve the objective of limiting global warming to 2 degrees Celsius, the target should be to double by 2030 the proportion of bioenergy in world energy demand, and to triple the proportion of sustainable low-carbon biofuels in transport fuels, including land, sea and air transport. It also indicated that scaling-up the bioeconomy is possible given smart agricultural practices, better use of rural and urban waste, and proper policies. IRENA's Renewable Energy Roadmap (ReMap) scenario foresees that, from the current level of 130 billion litres, by 2030 a global output of 500 billion litres of biofuels would be needed, expanding to 1,120 billion litres per year by 2050, to most cost-effectively contribute to the achievement of Paris Agreement goals.

This strategy can be applied to many countries and regions around the globe, as it is scalable, replicable, has no technical barriers for its implementation, and for these reasons can solve two of the biggest challenges facing humanity, namely global warming and the refugee, or employment, crisis.

Brazil's experience and vision for sustainable mobility is that it is possible to increase the use of high-density low-carbon liquid fuels, stimulating higher energy efficiency and lower environmental footprint, complementing renewable and traditional fuels in a virtuous way, using existing infrastructure, and promoting low cost fuel production and automobile technologies for local use and export.

We are moving towards the Age of Hydrogen. Hydrogen which is not necessarily produced, distributed and stored in high-pressure, costly and risky titanium tanks, but hydrogen which is also already existing and safely stored in high-density, low-carbon, sustainably produced and readily available for distribution advanced biofuels such as ethanol, biodiesel, biogas/biomethane and biokerosene.

[1] Balanço Energético Nacional, BEN, 2020, data for 2019.

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